Forestry Canada Forêts Canada

The influence of forest sector dependence on the socioeconomic characteristics of rural British Columbia

W.A. White, K.M. Duke and K. Fong

Information Report BC-X-314
Pacific and Yukon Region

The Pacific Forestry Centre is one of six regional and two national establishments of Forestry Canada. Situated in Victoria with a district office in Prince George, the Pacific Forestry Centre cooperates with other government agencies, the forest industry, and educational institutions to promote the wise management of the forest resources of British Columbia and the Yukon.

The Pacific Forestry Centre undertakes research in response to the needs of the various managers of the forest resource. The results of this research are distributed in the form of scientific and technical reports and other publications.

About the Authors

William A. White
Bill White is an economist with the Forest Development program of the Pacific Forestry Centre. His research work focusses on stand optimization and dynamic programming, and on forest-dependent communities in B.C.

Bill received his B.Sc. from Brigham Young University in 1977, an M.A. from the University of Regina in 1982, and a Ph.D. from Simon Fraser University in 1988.

Kenneth Duke
Kenneth Duke is in his second summer in the career-oriented student program at the Pacific Forestry Centre. He recently graduated from the University of Victoria with a B.A.

Kelly Fong
Kelly Fong was a summer student employed at the Pacific Forestry Centre in 1987. He recently graduated from the University of Victoria with a B.Sc.

The influence of forest sector dependence on the socioeconomic characteristics of rural British Columbia

by

W.A. White
K.M. Duke
and
K. Fong

Forestry Canada
Pacific and Yukon Region
Pacific Forestry Centre

BC-X-314

1989

90-02609/

Forestry Canada
Pacific and Yukon Region
Pacific Forestry Centre
506 West Burnside Road
Victoria, British Columbia
V8Z 1M5
Phone (604) 388-0600

© Minister of Supply and Services Canada, 1989
ISSN 0830-0453
ISBN 0-662-17359-7
Cat. No. Fo46-17/31 4E
Printed in Canada

Additional copies of this publication
are available in limited quantities
at no charge from the
Pacific Forestry Centre

Microfiches of this publication may be purchased from:

MicroMedia Inc.
Place du Portage
165, Hotêl-de-Ville
Hull, Quebec
J3X 3X2

Contents

Abstract/Résumé iv
Introduction 1
Methodology 1
Results 2
Summary and Conclusion 9
Acknowledgements 10
References 11

Appendices:

1. Census definitions and notes 23
2. Methodology 25

Abstract

Data from the 1981 and 1986 censuses are analyzed to determine the influence of forest sector dependence on various socioeconomic characteristics in rural British Columbia's incorporated communities and territorial subdivisions. The effects of relative population are also presented. Forest-specialized communities and regions were found to have the lowest employment multipliers. Unemployment rates in rural British Columbia increased substantially during the study period, regardless of the degree of forest sector dependence. Participation rates for men and young people decreased during the study period, while the rates for women increased. Forest-specialized communities and territorial subdivisions supported the highest male incomes in 1981 and 1986, though real male incomes fell during this period, in contrast to female real incomes which increased. The population of all forest sector dependence categories was better educated in 1986 than in 1981. The population of rural British Columbia stagnated in the early to mid-1980s as fewer people inmigrated and more outmigrated.

Résumé

Les données des recensements de 1981 et de 1986 sont analysées pour détermner l'influence de la dépendance à l'égard du secteur forestier sur diverses caractéristiques socio-économiques des communautés rurales constituées en corporation et des subdivisions territoriales de la Colombie-Britannique. Les effets de la population relative sont également présentés. Il a été découvert que les collectivités et les régions à vocation foretière avaient les multiplicateurs d'emploi les plus faibles. En Colombie-Britannique, le taux de chômage en milieu rural a énormément augmenté pendant la période d'étude, peu importe le degré de dépendance à l'égard du secteur forestier. Le taux d'activité des hommes et des jeunes gens a également diminué pendant la période d'étude, contrairement à celui des femmes qui a augmenté. Les collectivités et les subdivisions territoriales à vocation forestière attachaient le revenu le plus élevé pour les hommes en 1981 et 1986, bien que le revenu réel des hommes ait connu un recul pendant cette période, contrairement au revenu réel de femmes qui a augmenté. La population de toutes les catégories de dépendance à l'égard du secteur forestier était plus scolarisée en 1986 qu'en 1981. Du début au milieu des années 1980, la population rurale de la Colombie-Britannique a connu une période de stagnation au cours de laquelle l'exode rural a été plus marqué.

Introduction

The forest sector continues to be the dominant force in British Columbia's economy. Over 800 manufacturing and processing facilities employ about 78 000 workers directly and an estimated 156 000 indirectly while producing 45% of the province's manufacturing shipments (Council of Forest Industries 1987).

Outside of the lower mainland and the southern tip of Vancouver Island, the forest sector is particularly important. White et al. (1986) used data from the 1971 and 1981 censuses to classify the province's rural communities and territorial subdivisions[1] by degree of forest sector dependence[2]. The authors found 36 of 112 incorporated communities, 15 of 55 territorial subdivisions and 88 unincorporated communities within those territorial subdivisions which could be classified as forest sector specialized in 1981. The study also showed that between 1971 and 1981 the growth in the forest sector was centered in rural British Columbia.

The primary goal of this report is to expand upon the work of White et al. (1986) by analyzing data from the 1981 and 1986 censuses (Statistics Canada 1983, 1988) to determine the influence of forest sector dependence on various socioeconomic characteristics in rural British Columbia's incorporated communities and territorial subdivisions. For instance, how do incomes compare in forest sector specialized communities versus diversified communities?

Other reports have studied the characteristics of single-sector communities (Department of Regional Economic Expansion 1979; Canadian Employment and Immigration Commission 1987) and less populated centers in general (Hodge and Qadeer 1983; Qadeer and Chinnery 1986). A recent publication from Forestry Canada (Pharand 1988) identifies forest sector dependent communities across Canada and compares various characteristics to other rural and urban centers.

A knowledge of the specific characteristics unique to forest sector dependent communities and areas will assist federal and provincial policy-makers in designing and directing programs to help these areas in times of economic downturn. The information will also be valuable to communities and regions seeking to diversify their economies.

The period of study for this report is the decade from 1976 to 1986, during which there were two distinct economic climates. From 1976 to 1981 the economy of British Columbia was experiencing somewhat of a boom. Resource prices, particularly for forest products, were increasing rapidly, fuelling expansion and growth throughout much of rural British Columbia. During the early 1980s the economy entered a period of severe recession. The contrast between the two periods and the effects this contrast had on the socioeconomic characteristics of rural British Columbia are examined in this report.

Methodology

The methodology chosen to analyze the data was the analysis of variance method (ANOVA) for unequal group sizes. This method tests the mean values of various social and economic characteristics to determine if they are significantly different from each other depending on the degree of forest sector dependence in the community or region. This test only confirms that a difference exists but does not specify which categories of dependence may be different from each other. A further test on the mean values using the multiple comparison method is required to compare the mean values of the same social and economic characteristics to find where any differences indicated by the ANOVA test occur. This was done by comparing the first category mean to the second category mean, the first category mean to the third category mean and continuing until all the possible combinations were tested. For example, the mean of the dual category was compared to the mean of each of the other categories.

There are two disadvantages in choosing an unbalanced ANOVA design to analyze the data. First, the test statistic is relatively sensitive to small departures from the assumption of equal variances within the groups. The variances of small groups are given equal weight with the variances of larger groups. The pooled variance will tend to be skewed larger or smaller depending on the relative size of the group or

---

[1] See Appendix 1 for details on how incorporated communities and territorial subdivisions were classified for this report and for White et al. (1986). Appendix 1 also contains census definitions and notes.

[2] The following categories were used:
Forest-specialized: the forest sector alone dominates the economic base.
Dual: the forest sector and one other sector dominate the economic base.
Diversified: at least three sectors dominate the economic base and the forest sector is one of these.
Specialized non-forest: one non-forest sector dominates the economic base.
Minor or no forest: there is no forest sector component in the top five stated occupations.
For technical descriptions of what constitutes domination of the economic base, the reader is referred to White et al. (1986).

groups. This means the test will not be as accurate as a test of groups of equal size. Second, the power of the test is not maximized with samples of unequal sizes[3]. Reducing the power of the test increases the chance of accepting H_0 or the null hypothesis (no differences in means) when H_1 or the alternative hypothesis is true.

Another method used to obtain the means of the characteristics of units within groups separated by degree of forest sector dependence was to take weighted means. Means weighted by population are used to verify if the larger or smaller populated communities or regions affected the simple means. Weighted means were calculated by adding all the units within the same type (incorporated community or territorial subdivision) and the same division or degree of forest sector dependence, then dividing by the total population of the same type and same division. The simple means are the average of the means of the same type and division. An example calculation of simple and weighted means is shown below:

first mean = 80/400 = 0.2
second mean = 60/100 = 0.6
third mean = 80/100 = 0.8

The simple mean is (0.2 + 0.6 + 0.8)/3 = 0.53
and weighted mean = (80+60+80)/(400+100+100)
= 0.37

This example shows that the smaller value in the larger community may offset the other two means with the result that the larger community has more of an affect on the calculation of the weighted mean. It also implies that the percentages being studied tended to be higher in the less populated communities. Both simple and weighted means are provided in the results.

Details of the statistical methods used to assess differences between regions with differing levels of forest sector dependence are given in Appendix 2.

Results

The socioeconomic characteristics studied are grouped into five main areas:

Multiplier
Labor Force
Income
Education
Migration

Within each of these areas, socioeconomic characteristics are compared to determine the impact of degree of forest dependence. Weighted ratios are used to measure the impact of community or region population size on the results. This is done separately for the incorporated communities and territorial subdivisions for both 1981 and 1986.

Multipliers

The importance of the forest industry in British Columbia goes beyond direct employment in the industry itself. Employment is created in other sectors that service the industry and its employees. Jobs created by forest sector spending in other sectors are called indirect employment while employment sustained by forest sector employee spending is referred to as induced employment. The range of estimates for the number of jobs sustained in this way by the forest sector and its employees is usually between 1 and 2. This could be expressed as a multiplier of 2 or 3 since the total of direct, indirect and induced employment would be between two and three times the level of direct employment.

Many individuals have tried to measure or estimate employment multipliers for the forest sector in British Columbia and the Pacific Northwest. (Schallau et al. 1969; Reed and Associates 1972; Schuster et al. 1975; Bell 1977; Miller and Henry 1979). Estimating accurate employment multipliers is difficult as it requires a knowledge of where firms and employees spend their money and the level of employment generated. Techniques have been well documented by Schwartz (1982). Since visiting and surveying all communities and regions included in this study was not feasible, an alternative method using available census data was used to estimate multipliers for communities and territorial subdivisions with various degrees of dependence on the forest sector.

The Standard Industrial Classification Manual (Statistics Canada 1985) divides employment into 11 broad classifications outlined in Figure 1.

The census data combines the first four categories into one called "primary." These four along with manufacturing and construction are usually considered base activities while the remainder are classed as service activities (Economic Council of Canada 1984). Arguably, this is not a precise division. The construction industry could be a service industry when it is building an addition on a local sawmill while it is a base industry when its people work on a project in a neighbouring incorporated community or territorial subdivision. Community, business and personal services become part of the economic base of a community when they are used by towns and villages

[3] Where the power of the test is defined as one minus the probability of accepting H_0 when it is false or, alternatively, it is the probability of rejecting H_0 when H_0 is false.

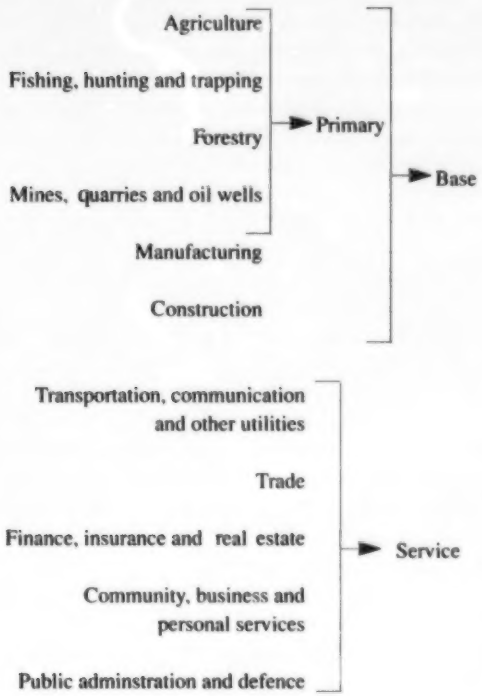

Figure 1. Classification of employment activity according to the Standard Industrial Classification Manual (Statistics Canada 1985).

some distance away which do not have the same infrastructure. Despite these potential shortcomings, this division was used for the study.

The 1981 and 1986 results indicate that local indirect and induced employment generated by the basic sector increased monotonically as the local community or region increased in diversification (Tables 1 and 2). Population and multipliers were also positively correlated in most cases. In 1981, forest-specialized communities had a multiplier of about 2.2, which increased to approximately 2.4 by 1986. Multipliers in forest-specialized territorial subdivisions increased marginally from 2.1 to 2.2. In every category the multiplier was higher in the incorporated communities than in the territorial subdivisions. This reflects a concentration of services in the larger incorporated communities as opposed to the smaller unincorporated rural communities.

Our more service-oriented society put upward pressure on multipliers between 1981 and 1986. Service employment has been increasing independently of basic employment in recent years. Each basic job is creating more indirect and induced employment than previously, which may tend to increase the amplitude of future employment cycles. Booms will bring about greater increases in employment while declines in demand, such as those which occurred in the early to mid-1980s, will see reductions in employment greater than have been witnessed in recent history. Moore (1987) argues that, since service sector employment is more stable than base employment, total employment is likely to be more stable over the business cycle.

The results demonstrate that the benefits of diversification go beyond buffering a community or region when one of the leading sectors falters. A diversified economic base has the ability to attract a greater variety of services than a specialized community because of the different services which may be required by the leading industries. Closer inspection of the data showed that the level of services in many of the diversified incorporated communities went beyond the level required for that community alone. Indeed, the service sector in many of these communities could be considered as part of the economic base providing surrounding communities with schooling, health care, and retail services, thereby contributing to the diversity of the local economy.

There appear to be two options for raising the low multiplier levels in the specialized communities. The most obvious solution is to attract other basic industries to the community or region. This can be difficult if the resource base does not exist to attract primary or manufacturing interests to the area. The second possibility is to establish services in the community or region that local industries and citizens can utilize rather than going elsewhere. This is a localized variation of import substitution. These services created for local use could also be "exported" to small surrounding communities currently traveling greater distances to obtain services.

While the above is certainly not a new idea it is one which deserves investigation in our more service-oriented economy (Economic Council of Canada 1984). The influx of women into the labor force, as indicated by rising female participation rates, has created a supply of workers for the service industries and, by taking women out of the home, increased the demand for personal services (Beach and Kaliski 1986). The specialized communities may have an opportunity to attract services at this time before they become established in the more traditional locations.

Labor Force

The labor force participation and unemployment rates were analyzed according to sex and age (Tables 3-6). The participation rate refers to the percentage of the total population eligible to work who are in the labor

force, employed or actively seeking employment. The unemployment rate is the percentage of the labor force that is unemployed.

Male participation rates were highest in the specialized communities and territorial subdivisions in 1981. This remained true in 1986, except for specialized non-forest communities. This supports the theory that individuals not participating in the work force do not remain in specialized communities. Male participation rates increased in the dual and forest-specialized communities, but fell in the others. In general, participation rates fell in the territorial subdivisions, the exception being the diversified category. It would seem that unemployed males had a greater tendency to remain in their communities or regions in 1986 than 1981. One could speculate that poor employment opportunities throughout British Columbia, particularly for the young, discouraged male workers from moving to other communities or regions to look for work. Married male participation rates tended to be higher in the specialized communities and regions in both 1981 and 1986, again in support of the theory mentioned earlier. However, in every category these rates declined between 1981 and 1986.

Female participation rates were not significantly different across dependence categories in either year. In general, there was an increase in female labor force participation, the exceptions being the territorial subdivisions with a minor or no forest sector and specialized non-forest territorial subdivisions. Married female participation rates tended to be lower than total female participation rates in 1981; however, by 1986 they were equal or higher. One possible explanation for this trend is that married women increased their supply of labor in response to higher male unemployment and declining male real incomes (see the section on Income).

Young persons (15-24) in the forest-specialized communities and regions had the lowest participation rate of any category of forest sector dependence in both 1981 and 1986. Except for the diversified territorial subdivisions, participation rates in all categories of dependence fell. This is indicative of the poor employment prospects for younger workers throughout rural British Columbia, and in the forest sector in particular, during this period.

Participation rates for those 25 and older increased in the dual and forest-specialized communities between 1981 and 1986; however, they declined in the other categories. In the territorial subdivisions, participation rates increased in every category except specialized non-forest. This trend is a reflection of the increase in the number of women, in particular married women, in the labor force.

Unemployment rates increased in every sex, age, and dependence category between 1981 and 1986. Male unemployment rates experienced the most substantial jumps during this period, in many cases doubling and even tripling. Forest-specialized communities and regions had the highest rate of male unemployment in 1981. However, they experienced the lowest increase of all the dependence categories between 1981 and 1986, moving them to the lower end of the ranking by 1986. There are a number of possible explanations for this change. One is that the recession that hit most of British Columbia in 1982-1983 was already impacting the forest sector by census day 1981. Therefore, unemployment rates were already rising before the census. Another possible explanation is that lower levels of induced employment in the forest-specialized communities and regions, as indicated by lower multipliers relative to other dependence categories, mean that fewer people will be put out of work for each base industry job that is lost. Therefore, one would expect lower increases in unemployment rates during economic downturns.

The female unemployment rate in the forest-specialized communities and territorial subdivisions was among the highest in 1981, but fell slightly in ranking by 1986, much as the male rate had. In general, increases in female unemployment were not as severe as for males.

Unemployment rates among the young doubled from 1981 to 1986. Forest-specialized communities and regions had one of the highest rates of youth unemployment in 1981 and this continued into 1986. Considering the severity of the recession in the early 1980s and the vulnerability of young people during such economic downturns, substantial increases in unemployment are not surprising.

Workers aged 25 and over also experienced higher rates of unemployment in 1986 than in 1981 in every category, community, and territorial subdivision. The largest increase was experienced in the specialized non-forest communities. Although the magnitude of the increase was not as great as for young workers, it was nevertheless substantial. Again, forest-specialized communities and regions had some of the highest rates of unemployment for those 25 and over in 1981, but these unemployment rates increased at a lower rate than those in the other categories of forest sector dependence.

Employment opportunities in rural British Columbia were hampered by the recession of the early 1980s. A smaller percentage of males and young people and a larger percentage of females, particularly married females, participated in the labor force in 1986 than in 1981. Unemployment rates doubled and in some cases tripled during this period. Males and young

workers were particularly affected. Forest-specialized regions and communities had the highest rates of unemployment in 1981; however, they experienced slower increases than other dependence categories between 1981 and 1986. The fact that the recession was already affecting the forest sector in 1981, combined with lower multipliers and therefore less secondary employment loss during economic downturns, are possible explanations.

Income

Male and female income characteristics, as well as the incidence of low individual and family incomes, were investigated (Tables 7-12).[4] In 1981, average male income in the forest-specialized communities was significantly higher than that in all other dependence categories except the second-ranking specialized non-forest group. These communities also exhibited a greater variation in male income. This remained true in 1986 except that male incomes in the forest-specialized communities now differed significantly only from those in the diversified communities.

Comparisons of 1981 and 1986 nominal incomes fail to reflect changes in purchasing power. Although nominal incomes for males increased by 10% to 30% during this period, real incomes, deflated to 1981 price levels, actually fell in the diversified and forest-specialized communities.[5] The other categories experienced small increases in real income. Plausible explanations for the decline and stagnation of real male income are the increase in male unemployment rates and, more specifically, the decline in forest sector employment as firms modernized following the recession.

Male incomes in forest-specialized territorial subdivisions rank second behind those in specialized non-forest territorial subdivisions but, in contrast to the findings for incorporated communities, had the lowest variation in income in 1981. Smaller mills and a greater proportion of logging employment may explain the lower income variation. The incorporated communities have larger mills which would require more skilled workers, more senior management, and carry more lower-paid entry positions. The higher employment multiplier for incorporated communities also points to more lower paying service jobs. By 1986, forest-specialized regions had the highest average male income and continued to have the lowest income variation. Real income fell by between 2% and 15% across all categories of territorial subdivisions. Again, recessionary pressures were the likely cause.

In both 1981 and 1986 female average income was nearly equal across all categories in the incorporated communities. The standard error of female income was significantly higher in the forest-specialized communities in 1981, but not in 1986. Forest specialization and minor or no forest sector were associated with higher female incomes in the territorial subdivisions in 1981, while higher female incomes were associated with the minor or no forest sector regions in 1986. The variation in income tended to be much lower in the territorial subdivisions. Real female incomes increased by 3% to 13% during this period, the largest increase being in the specialized non-forest communities and minor or no forest sector regions. A probable reason for this increase is that women, particularly married women, supplied more labor in 1986 than in 1981 to compensate for reduced male incomes. The service sector likely absorbed this increased supply of labor (see the section on Multipliers).

In 1981 there were no significant differences in the incidence of low family incomes across all categories in the incorporated communities. Between 1981 and 1986 the incidence of low income families increased in all dependence categories in both the communities and regions with the largest increase occurring in the specialized non-forest communities. Again, the best explanation for this increase is the recession of the early 1980s that reduced real average family incomes. Forest-specialized communities had the smallest increase in low income families. In 1981, the specialized territorial subdivisions had the lowest incidence of low family income and had sharply and significantly lower levels of low individual income than diversified territorial subdivisions. Although forest-specialized regions continued to have the lowest incidence of low income families in 1986, they were not significantly lower than any other category. There are at least two possible explanations for the smaller percentage of low income families. First, the forest sector pays relatively high wages and salaries. Secondly, as mentioned earlier, unemployed workers are less likely to remain in specialized communities; this is especially true of those unemployed workers who must support a family.

The lowest incidence of low individual income occurred in both forest-specialized and specialized non-forest communities and regions in 1981. Again,

---

[4] Median income is also reported in the census reports. A comparison of median income with average income did not reveal large differences in the two so only one is reported here.

[5] 1986 nominal prices were deflated to 1981 price levels using the all British Columbia price index obtained through personal communication with Statistics Canada. The deflator used was 1986 = 128.6 (1981 = 100).

this supports the theory mentioned earlier with respect to unemployed individuals in specialized communities and regions. By 1986 this was no longer true; however, this is less a dismissal of the theory than a reflection of the overall increase in low income individuals across all dependence categories. There are a number of possible explanations why these increases occurred. One is the lack of employment elsewhere, particularly for young men and women between 15 and 24 years of age; hence, there was a lack of incentive to move out of these communities or regions. Furthermore, real incomes declined in the forest-specialized communities and non-forest specialized territorial subdivisions; therefore, some people who would have been above the low income threshold in 1981 would have fallen below it by 1986.

The recession of the early 1980s had a major impact on rural British Columbia, an impact that lingered on well after the Canadian economy had begun its recovery. Real incomes were lower, the incidence of low income for both families and individuals was higher and unemployment was greater in 1986 than 1981 despite 14 consecutive quarters of real growth in gross domestic product prior to census day, 1986. The dependence of much of rural British Columbia on the resource sector and the sluggish response of resource prices to the national economic upturn is a key reason for these trends (Little 1987).

Education

The 1981 data for the highest level of education obtained (Tables 13-16) were similar across all of rural British Columbia. Education levels generally did not vary between categories of forest sector dependence, incorporated communities, and territorial subdivisions or heavily and lightly populated areas. The 1986 data similarly showed little difference. In almost every category of education there were increases between 1981 and 1986. The most substantial increase was in the area of non-university post-secondary education, such as community college diplomas, where all categories of forest dependence increased by 3%-5%. The largest and most significant increases occurred in the minor or no forest and specialized non-forest communities and territorial subdivisions. The percentage of those with university degrees and high school diplomas also increased.

Rising levels of educational attainment indicate that more people in rural communities and regions decided to complete their high school education or returned to school to upgrade their skills. This is a reflection of both increased access to education, particularly through local colleges, and the poor prospects for unskilled employment in the 1980s.

One disturbing trend between 1981 and 1986 is that the percentage of those 15 and over with less than a grade 9 education increased in the specialized communities and all categories of territorial subdivisions except those with diversified economies. The reasons for such an increase are not entirely clear; this trend ran counter to the increases witnessed in the other education categories.

A further comparison was made with the Greater Vancouver Regional District and the Capital Regional District (Victoria). It is generally accepted that, largely as a result of better access to post-secondary education, urban areas will have higher levels of education. At the university level this was borne out: about 5% more of the population of urban areas over age 15 had university degrees in both 1981 and 1986. However, the urban-rural gap in the area of high school graduates narrowed during this period, while it disappeared in the area of non-university education. The gap between urban and rural communities in the percentage of those 15 and over with less than a grade 9 education increased.

Migration

Community stability in forest based economies has been the subject of numerous studies (Le Master and Beuter 1989; Western Wildlands 1983). While community stability can imply stability in population, employment, wood flow, income or other factors, this section of the report will focus on the relative abilities of incorporated communities and territorial subdivisions to maintain their population levels and to attract new migrants. The ratio of total outmigrants to population and inmigrant-outmigrant ratios can be used as measures of stability. Other factors to be reviewed in this section are the propensity of people to move and where inmigrants tend to come from. Ratios relating to these factors are expressed as percentages in Tables 17 through 20.

The population of rural British Columbia grew by approximately 17% from 1976 to 1986. However, this growth rate is somewhat deceiving. A clearer picture of the pattern of population change emerges if we examine the 1976-1981 and 1981-1986 periods separately. From 1976 to 1981, the population grew by 166 768, or 15.1%. However, from 1981 to 1986 there were only 20 360 additional people in rural British Columbia, a growth rate of about 1.6%. This growth was well below the rate of natural increase for this period, indicating that a large number of persons left the province or moved to the larger urban centers in the southwest, and that few chose to inmigrate.

This population growth pattern mimics the economic cycle that occurred during this period.

Resource prices, particularly in the forest products sector, were increasing steadily from 1976 through 1981, but by 1981-82 these had begun to decline substantially. Prices in most sectors did not begin to recover from the recession until 1983-84, or later in some cases. The discussion that follows attempts to explain the number of people who outmigrated, the number who inmigrated, and whether the degree of forest sector dependence had any effect on migration patterns.

i. Propensity to move and inmigration

About 60% of the rural population changed residence between 1976 and 1981. Between 1981 and 1986 this fell to approximately 45%. This 15% decline is related to a similar decline in inmigrants, the reasons for which are discussed below. The propensity of people to change residence was not affected by the degree of forest sector dependence or by living in an incorporated community or territorial subdivision in either of the periods in question. Population was not a factor between 1976 and 1981; however, there was a greater propensity to move in units with a smaller population between 1981 and 1986.

A high ratio of inmigrants to total population can mean either that a community is thriving and attracting workers and families from other places or that there is a high turnover of population with many inmigrants and outmigrants. Inmigrant to outmigrant ratios, presented later in this section, provide a better indication of growth in a category.

In 1981, about 40% of the rural population were classed as inmigrants (i.e. 40% of the 1981 population moved into the community they were living in between 1976 and census day 1981). By 1986 this had fallen to approximately 25%. This decline can be traced to the effects of the recession of the early to mid 1980s. The resulting decline in employment opportunities removed most incentive for people to inmigrate to these communities. The percentage of inmigrants in forest-specialized incorporated communities was in the middle of the range of values and did not differ significantly from any other category in both census years. With the exception of the specialized non-forest sector in 1981, the weighted means for both 1981 and 1986 indicate that smaller incorporated communities had a slightly higher percentage of inmigrants.

A wider range of values was found for the territorial subdivisions. As in the communities, there was a decline in the percentage of the population classified as inmigrants, from approximately 35% in 1981 to 25% in 1986; again, this was a result of the 1980s recession. The decrease in forest sector employment opportunities is reflected in the fact that forest-specialized territorial subdivisions had the lowest percentage of inmigrants at 31% in 1981 and 20% in 1986. This differed significantly from all other categories of dependence except diversified in 1981 and specialized non-forest in 1986. The less populated regions had a marginally higher percentage of inmigrants in both years.

About 50% of inmigrants to a given community or territorial subdivision came from other census divisions within British Columbia in both 1981 and 1986. The only exception to this trend in 1981 was the minor or no forest sector category (43%) in both the incorporated communities and the territorial subdivisions, and the minor or no forest sector and specialized non-forest categories in 1986. The communities and regions with minor or no forest sector included many farming and mining communities as well as tourist centers and armed forces bases. In contrast to forest-specialized units, these communities (with the exception of mining communities) required people of very general skill levels as opposed to the specialized skills of the forest sector. The close proximity of many of the mining communities (and some of the farming regions) to the Alberta border and the high turnover at armed forces bases would also influence the results. Larger incorporated communities attracted relatively more inmigrants from outside British Columbia in both 1981 and 1986.

Forest-specialized incorporated communities attracted 16% of their inmigrants from within the same census division in 1981 and 1986. This did not differ significantly from any other category. The smaller incorporated communities, especially those in the forest-specialized and specialized non-forest categories, attracted a greater percentage of inmigrants from nearby relative to larger communities in both years. Forest-specialized territorial subdivisions attracted the smallest percentage of inmigrants from within the same census division (11%) in 1981 and again in 1986 (16%). This differed significantly from territorial subdivisions in the diversified and specialized non-forest categories in 1981 and with territorial subdivisions in the minor or no forest sector categories in 1986. Overall, the weighted means for 1981 show that the lowest level of inmigration from within the same census division is found in the forest-specialized category both in the incorporated communities and territorial subdivisions. In 1986, this was true only for the forest-specialized incorporated communities.

Forest-specialized and specialized non-forest incorporated communities and territorial subdivisions attracted the lowest percentage of out of province inmigrants in 1981 while those in the minor or no

forest sector categories received the greatest percentage of interprovincial inmigrants. This is consistent with the explanation provided in the discussion above of inmigration from within British Columbia. The only change in 1986 was in the territorial subdivisions where specialized non-forest regions had the lowest percentage of inmigrants from other provinces. Interprovincial inmigrants tended to go to the more populated rural communities in 1981 and 1986; the only exception to this trend in 1986 occurred in forest-specialized communities. Population was not an important factor in the results for territorial subdivisions in 1981; however, in 1986 the weighted averages indicate that inmigrants from other provinces tended to move to the more populated regions.

An average of between 4% and 9% of the inmigrants between 1976 and 1981 came from outside Canada in both groups and all categories. In 1986, the percentage of inmigrants from outside of Canada had fallen in most categories and groups to between 2% and 6%. The sole exception (specialized non-forest territorial subdivisions) cannot be considered significant because of the low number of observations.

ii. Outmigration

Outmigration rates reflect the ability of a community or territorial subdivision to hold its population. Low outmigration rates, when accompanied by high inmigration, could reflect a thriving economy, or, if accompanied by low inmigration, a stable or stagnant economy.

Generally, the degree of forest sector dependence had little effect on the number of people who left a community or region from 1976 through 1986[6]. The only exception in 1981 occurred in those communities that were forest-specialized and those with minor or no forest sector, where forest specialization was associated with significantly higher outmigration.

A smaller percentage of the population left the incorporated communities between 1981 and 1986 than between 1976 and 1981. The opposite held true in the territorial subdivisions, where outmigration rates tended to increase. One possible explanation for this could be that workers in the communities saw little advantage in leaving as most communities in rural British Columbia were suffering from the effects of the recession. People in the regions were hit significantly harder by the economic downturn and therefore had more incentive to move either to incorporated communities or to the larger urban centers in the south.

Any significant differences in the level of outmigration that existed in 1981 and 1986 disappear when one considers the weighted means. The figures show less variation than the simple mean, implying that population was an important factor in determining the level of outmigration from a community or region. Between 1976 and 1986, less populated areas generally had a larger percentage of people leave than the larger centers. Since community or subdivision population was also shown to decrease inmigration rates, it can be concluded that the less populated communities and regions experienced more population turnover than the more populated units.

In 1981, outmigration rates for the territorial subdivisions were one-third to one-half those found in the incorporated communities. This could be explained in two ways. First, it is harder to outmigrate from a territorial subdivision. They cover a much larger geographical area and a move within one, even if it is to a different community within the subdivision, does not count as outmigration. If this were a plausible explanation we would expect to see lower inmigration rates in the regions since moves within the subdivisions would not be counted as inmigration. Lower inmigration rates were not found for territorial subdivisions. The second, and simplest, explanation is that people living in the territorial subdivisions had a lower propensity to leave the area they were living in than people in the incorporated communities. Between 1981 and 1986, however, outmigration rates for incorporated communities and the regions converged. Hard economic times and poor employment prospects in the territorial subdivisions forced more inhabitants to leave over this period.

iii. Inmigrant-Outmigrant Ratios

The ratio of inmigrants to outmigrants was calculated to determine the relative rate of migration-related growth or decline. A ratio of one indicates that the same number of inmigrants are entering a community or region as are leaving. A ratio of less than one means more are leaving than entering, and a ratio greater than one means more are entering than leaving.

The ratios in 1981 were much higher in the territorial subdivisions than in the incorporated communities, with the highest ratios being attributed to the less populated subdivisions. This finding cannot be immediately connected with the counter-urbanization movement experienced in the 1970s as it was low outmigration rather than high inmigration that set the subdivisions apart.

---

[6] Due to changes in Statistics Canada reporting methods, outmigration numbers were not reported in the 1986 census. Therefore, these numbers had to be estimated. Appendix 1 details the estimation procedure used.

The forest-specialized regions and communities had some of the lowest inmigrant-outmigrant ratios. It can be concluded that forest-specialized centers were not attracting large numbers of workers from other areas during this period, and that the existing labor force in the community or region was able to meet the needs of the industry.

The 1986 ratios indicate declines in every category, particularly in the regions. Most communities had an inmigrant-outmigrant ratio of at least one in 1981. By 1986, every dependence category had fallen to between 0.70 to 0.95, the most significant declines being in the diversified and minor or no forest sector communities. Since the outmigration ratios actually fell in this period, the decline in inmigrant-outmigrant ratios can be attributed to the fall in inmigrants. Workers chose not to leave their communities, perhaps seeing little opportunity elsewhere, while at the same time fewer people chose to move to the rural communities.

Inmigrant-outmigrant ratios in the territorial subdivisions were significantly higher than the communities in 1981, indicating a much greater propensity for people to move to the territorial subdivisions than to leave them. However, between 1981 and 1986 these ratios declined substantially, in some cases to only one-fifth of the 1981 ratios. The combination of declining inmigration and increasing outmigration explains this trend. The territorial subdivisions were especially vulnerable to economic downturn, and there was little incentive not only for people to move there, but also for the residents to stay.

Forest-specialized communities and territorial subdivisions consistently enjoyed the highest average male incomes as well as the greatest variation in income across the population. In general, real male incomes stagnated or declined between 1981 and 1986, while female incomes experienced increases. The number of low-income families and individuals increased across all categories of forest sector dependence.

The direction of shifts in educational attainment between 1981 and 1986 was generally encouraging. More people had high school diplomas, community college diplomas, and university degrees in 1986 than in 1981. The only discouraging statistic was the increase in the number of persons 15 and older with less than a grade 9 education. In general, the educational gap between the urban and rural areas declined; this was a result of increased educational access and a greater desire to upgrade skills.

Rural British Columbia's population experienced two distinct periods of growth between 1976 and 1986. For the first 5 years it grew at a very rapid rate, as did the provincial economy; however, it stagnated after 1981. Fewer people inmigrated to and more outmigrated from rural British Columbia in 1986 than in 1981. The majority of the people who did inmigrate came from within British Columbia, and areas with specialized economies had the lowest percentage of inmigrants of this type. The number of immigrants from other provinces and outside of Canada fell. While outmigration fell in the incorporated communities, it increased in the territorial subdivisions. Outmigration tended to be higher in the smaller communities. Inmigration-outmigration ratios fell between 1981 and 1986, particularly in the regions, to less than one. This indicates a negative net flow of migrants during this period.

Summary and Conclusion

Summary

Diversification was shown to generate greater associated employment than specialization. There may be an opportunity in light of the increased number of services being used by business and individuals for specialized communities to attract more services to their communities and thereby provide employment opportunities, particularly for young people.

Unemployment rates throughout rural British Columbia doubled and tripled as mills and mines closed. Fewer married and single males and fewer young people participated in the work force in 1986 than in 1981. In contrast, more women, particularly married women, supplied labor to the market during this period; this was likely a response to declining male incomes. The young were especially hard hit by this period of economic downturn.

Conclusion

The importance of the forest industry to British Columbia cannot be overstated. Outside of the major southwestern urban centers, 30% of all communities and regions are dependent solely on the forest sector for their economic well being, and another 40% rely on the forest industry as one of their top three employers. During times of economic growth, this dependence has been a boon for rural British Columbia as the forest sector has consistently paid high wages and salaries. However, this dependence has left much of the province vulnerable to economic downturns, such as the recession of the early 1980s. This vulnerability is evident in many of the socioeconomic characteristics examined in this report.

Forest-specialized communities and regions have the lowest employment multipliers of any dependence category. This lack of a diversified economic base has made these areas particularly vulnerable to declines in resource prices. Workers are unable to find alternate employment within these communities and regions and are often forced to leave. High male and married male participation rates reflect this phenomenon. Younger workers, often the hardest hit in times of recession, appear to have a greater tendency to remain in their communities and regions, despite high unemployment rates. Although unemployment rates increased substantially throughout the province between 1981 and 1986, the rate of increase was lower in the forest-specialized communities and regions. The earlier impact of the recession on the forest industry relative to other industries, and the low employment multipliers are possible explanations. Inmigration to the forest-specialized communities and regions, particularly from other provinces, declined between 1981 and 1986. Concurrently, forest-specialized communities experienced higher rates of outmigration.

The negative economic indicators apparent in the forest-specialized areas were not unique. Certainly the recession of the 1980s had a strong and lingering impact on the entire economy of rural British Columbia. Even diversified communities and regions suffered, although to a lesser degree than the specialized areas. Unemployment and outmigration from rural British Columbia increased, while real male incomes and inmigration declined. These basic statistics are good indicators of economic hardships.

The results of this paper indicate areas where further research might be valuable. For example, it would be interesting to re-examine the work of White et al. (1986) to see if the number of forest-dependent communities and territorial subdivisions in British Columbia has increased or decreased. It would also worthwhile examining how forest-specialized communities have responded to the recession, and whether diversification in rural British Columbia has increased. Finally, the effects of community and region size on local economic stability deserve some exploration

Acknowledgements

The authors benefited from the comments of N. Pharand and L. Rugo of Forestry Canada's Labor Development Branch, S. Anderson and A. Ghebremichael of the Great Lakes Forestry Centre and G. Manning, G. Townsend and S. Glover at this centre.

References

Beach, C.M.; Kaliski, S.F. 1986. Structural unemployment, demographic change or industrial structure? Canadian Public Policy XII:2:356-367.

Bell, E. 1977. Estimating effect of timber harvesting levels on employment in Western United States. USDA For. Serv. Res. Note INT-237. Intermountain Forest and Range Experiment Station. Ogden, Utah.

Canadian Employment and Immigration Commission. 1987. Canada's single-industry communities: a proud determination to survive. Minister of Supply and Services.

Council of Forest Industries of British Columbia. 1987. British Columbia forest industry fact book - 1987. Council of Forest Industries of British Columbia. Vancouver, British Columbia

Department of Regional Economic Expansion. 1979. Single sector communities. Minister of Supply and Services.

Economic Council of Canada. 1984. Western transition. Minister of Supply and Services.

Hodge, G.; Qadeer, M. 1983. Towns and villages in Canada. Butterworth, Toronto, Ont.

Huntsberger, D.V.; Billingsley, P. 1973. Elements of statistical inference. 3rd edition. Allyn and Bacon, Boston.

Larson, R.J.; Marx, M.L. 1981. An introduction to mathematical statistics and its applications. Prentice-Hall Inc., Englewood Cliffs, N. J.

Little, B. 1987. What's wrong with the boom. Report on Business. August 1987.

Le Master, C.; Beuter, J.H., editors. 1989. Community stability in forest-based economies: conference proceedings. Timber Press. Portland, Oregon.

Miller, S.E.; Henry, M.S. 1979. Basic and non-basic employment linkages. Review of Regional Studies 9(2):80-88.

Montgomery, D.C. 1976. Design and analysis of experiments. 2nd edition. John Wiley & Sons, U.S.A.

Moore, G.H. 1987. The service industries and the business cycle. Business Economics. April 1987.

Pharand, Nicole L. 1988. Forest sector-dependent communities in Canada: a demographic profile. Can. For. Serv. Inf. Rep. DPC-X-23. Labor Market Development Branch, Forestry Canada, Ottawa.

Qadeer M.; Chinnery, K. 1986. Canadian towns and villages: an economic profile. Research and working paper No. 14. Institute of Urban Studies. University of Winnipeg.

Reed and Associates. 1972. The British Columbia forest industry: its direct and indirect impact on the economy. F.L.C. Reed and Associates. Vancouver, British Columbia

Schallau, C.; Maki, W.; Beuter, J. 1969. Economic impact projections for alternative levels of timber production in the Douglas-fir region. Annals of Regional Science 3(1):96-106.

Schuster, E.G.; Hatch, C.R.; Koss, D.W. 1975. Location quotients, excess employment and short run economic base multipliers for Idaho's forest products industry. Information Series 10. University of Idaho, Wildlife Range Experimental Station, Moscow.

Schwartz, H. 1982. A guide to regional multiplier estimation. Canada Department of Regional Economic Expansion. Minister of Supply and Services.

Statistics Canada. 1983. 1981 Census of Canada: Selected social and economic characteristics, British Columbia. 93-x-946. Minister of Supply and Services.

Statistics Canada. 1988. 1986 Census of Canada: Profiles, British Columbia, Part 2. 94-120. Minister of Supply and Services.

Statistics Canada. 1985. Standard industrial classification. 1980. Minister of Supply and Services.

Western Wildlands. 1983. Vol. 8(4). Special issue: the effects of timber harvesting policies on community stability. Montana Forest and Conservation Experiment Station, University of Montana, Missoula. 44 p.

White, W.; Netzel, B.; Carr S.; Fraser, G.A. 1986. Forest sector dependence in rural British Columbia 1971-1981. Can. For. Serv. Pac. For. Cent. Inf. Rep. BC-X-278. Victoria, B. C.

Table 1. 1981 employment multipliers for incorporated communities and territorial subdivisions. Numbers in parentheses are weighted means.

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest specialized 3	Minor or no forest 4	Specialized non-forest 5
Incorporated communities	2.64 (2.67)	3.02[3] (3.42)	2.15[4] (2.42)	3.26 (2.96)	2.53 (2.04)
Territorial subdivisions	2.13[5] (2.24)	2.35[3,5] (2.45)	2.10 (2.09)	2.27 (2.77)	1.66 (1.82)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 2. 1986 employment multipliers for incorporated communities and territorial subdivisions. Numbers in parentheses are weighted means.

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest specialized 3	Minor or no forest 4	Specialized non-forest 5
Incorporated communities	3.15[3] (3.17)	3.36[3] (3.95)	2.36[4] (2.68)	3.35 (3.40)	2.98 (2.63)
Territorial subdivisions	2.33[2] (2.43)	2.73[3] (2.64)	2.20 (2.23)	2.53 (2.48)	2.53 (2.66)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 3. 1981 Labor force characteristics in incorporated communities. Numbers in parentheses are weighted means.

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest-specialized 3	Minor or no forest 4	Specialized non-forest 5
Participation(%)					
Labor force	64 (65)	63 (67)	66 (68)	63 (62)	67 (67)
Male	75 (77)	76 (80)	79 (84)	76 (75)	79 (82)
Female	51 (51)	50 (55)	50 (51)	49 (50)	52 (47)
Married males	83.1	80.2[3]	86.9[4]	79.2	85.8
Married females	50.7	48.9	48.0	48.6	50.8
Both sexes, 15-24	69.8	68.0	62.9	65.3	67.1
Both sexes, 25 +	64.0	63.1	66.7	63.0	67.6
Unemployment (%)					
Male	6.6	6.1	8.3	6.9	5.3
Female	10.3	9.6	11.9	11.2	13.9
Both sexes, 15-24	11.7	11.6	13.1	12.3	13.1
Both sexes, 25 +	6.4	6.3	8.1	7.0	6.5

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 4. 1981 Labor force characteristics in territorial subdivisions. Numbers in parentheses are weighted means.

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest-specialized 3	Minor or no forest 4	Specialized non-forest 5
Participation (%)					
Labor force	66 (64)	63[5] (61)	65 (64)	67 (65)	70 (66)
Male	79[5] (78)	73[3,5] (75)	81 (80)	77[5] (77)	88 (83)
Female	47[4] (43)	47[4] (43)	47[4] (41)	56[5] (46)	46 (39)
Married males	84.0	81.4	86.2	81.0	91.1
Married females	45.6	46.0	45.9	48.6	43.6
Both sexes, 15-24	61.6	62.8	61.1	64.7	61.0
Both sexes, 25 +	65.4	63.1	66.4	65.9	72.1
Unemployment (%)					
Male	7.0	7.8	8.4	5.5	3.5
Female	11.5	10.4	11.2	10.4	7.7
Both sexes, 15-24	12.1	13.4	14.8	12.7	10.5
Both sexes, 25 +	7.3	7.4	7.7	5.8	4.0

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 5. 1986 Labor force characteristics in incorporated communities. Numbers in parentheses are weighted means.

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest-specialized 3	Minor or no forest 4	Specialized non-forest 5
Participation (%)					
Labor force	65 (65)	63 (65)	66 (67)	62 (60)	65 (67)
Male	76 (77)	74[3] (76)	81[4] (81)	74 (71)	75 (77)
Female	54 (54)	52 (54)	50 (53)	50 (50)	55 (56)
Married males	81.4	77.4[3]	85.6[4]	77.8	81.7
Married females	55.3	51.9	50.8	51.1	53.3
Both sexes, 15-24	67.6[3,4]	65.1	61.3	60.1	62.6
Both sexes, 25 +	64.8	62.4	67.6[4]	62.6	67.1
Unemployment (%)					
Male	13.2	15.8[3]	12.7[5]	13.6	17.7
Female	16.0	15.0[4,5]	16.8	18.1	20.0
Both sexes, 15-24	23.4	22.6	25.9	25.5	23.7
Both sexes, 25 +	11.8[3,5]	13.8[5]	11.7[5]	12.8[5]	18.3

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 6. 1986 Labor force characteristics in territorial subdivisions. Numbers in parentheses are weighted means.

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest-specialized 3	Minor or no forest 4	Specialized non-forest 5
Participation (%)					
Labor force	66 (64)	65 (63)	66 (64)	66 (63)	71 (66)
Male	78 (76)	76 (75)	79 (78)	76 (73)	82 (78)
Female	53 (51)	54 (51)	51 (49)	55 (53)	57 (52)
Married males	81.8	80.0	84.6	79.1	87.1
Married females	52.6	53.1	51.3	55.4	52.6
Both sexes, 15-24	61.5[5]	63.8[5]	59.5[5]	61.6[5]	74.7
Both sexes, 25 +	67.6	66.0	67.6	66.8	71.0
Unemployment (%)					
Male	17.3	14.9	13.7	12.8	15.7
Female	19.0	16.6	16.0	14.9	12.0
Both sexes, 15-24	26.6	26.6	25.8	20.9	24.6
Both sexes, 25 +	15.7	13.5	12.1	12.2	11.7

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 7. 1981 income characteristics of incorporated communities

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest-specialized 3	Minor or no forest 4	Specialized non-forest 5
Total average income ($/yr)					
Male	18 274 [3]	17 496 [3]	19 950 [4]	17 894	17 978
Average error of male	880	844 [3]	1134 [4]	832	929
Female	7867	7657	7679	7842	7833
Average error of female	471 [3]	447 [3]	703 [4]	528	617
Incidence of low-income(%)					
Families	9.9	9.3	10.0	8.8	8.0
Individuals	38.4[3]	35.3	29.6	32.9	29.2

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 8. 1981 income characteristics of territorial subdivisions

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest specialized 3	Minor or no forest 4	Specialized non-forest 5
Total average income ($/yr)					
Male	17 168 [3,5]	16 994 [3,5]	18 690	18 048 [5]	21 585
Average error of male	882 [3]	722	612	750	1061
Female	7148 [3,4]	7174 [4]	7684	8140	7003
Average error of female	555 [5]	444 [5]	439 [5]	396 [5]	972
Incidence of low-income (%)					
Families	12.9[3]	10.7	8.5	10.2	9.3
Individuals	31.8[2,5]	38.6[3,4,5]	30.8	29.6	20.0

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 9. 1986 income characteristics of incorporated communities

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest specialized 3	Minor or no forest 4	Specialized non-forest 5
Total average income ($/yr)					
Male	23 946	21 428 [3]	25 102	23 399	23 290
Average error of male	1030 [3]	1108	1382 [4]	1068	1420
Female	10 892	10 954	10 567	10 732	11 398
Average error of female	691	703	939	772	896
Incidence of low-income(%)					
Families	14.0[5]	15.9[4]	13.4[5]	12.2[5]	19.0
Individuals	35.2[3]	36.2	36.4[4]	31.3	31.8

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 10. 1986 income characteristics of territorial subdivisions

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest Specialized 3	Minor or no Forest 4	Specialized non-forest 5
Total average income ($/yr)					
Male	21 396 [3]	21 609	23 484	22 041	23 365
Average error of male	989 [5]	1066 [5]	873 [5]	1037 [5]	2171
Female	10 137 [4]	10 298 [4]	10 448 [4]	11 757 [5]	9286
Average error of female	724 [5]	623 [5]	588 [5]	612 [5]	1194
Incidence of low-income (%)					
Families	14.9	15.5	13.4	13.7	14.4
Individuals	29.6	29.8	26.8	25.8	27.4

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 11. 1986 real income in the incorporated communities (1981=100)

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest specialized 3	Minor or no Forest 4	Specialized non-forest 5
Male total average income ($/yr)	18 621	16 663	19 519	18 195	18 110
Ratio of 1986 male real income to 1981 real income	1.02	0.95	0.98	1.02	1.01
Female total average income ($/yr)	8470	8518	8217	8345	8863
Ratio of 1986 female real income to 1981 real income	1.08	1.11	1.07	1.06	1.13

Table 12. 1986 real income in the territorial subdivisions (1981=100)

	Degree of forest sector dependence				
	Dual 1	Diversified 2	Forest specialized 3	Minor or no Forest 4	Specialized non-forest 5
Male total average income ($/yr)	16 637	16 803	18 261	17 139	18 169
Ratio of 1986 male real income to 1981 real income	0.97	0.99	0.98	0.95	0.84
Female total average income ($/yr)	7 883	8 008	8 124	9 142	7 220
Ratio of 1986 female real income to 1981 real income	1.10	1.12	1.06	1.12	1.03

Table 13. Percentage of the 1981 population aged 15 and over in incorporated communities who had completed various levels of schooling. Numbers in parentheses are weighted means.

	Degree of forest sector dependence									
Highest level of schooling	Dual 1		Forest-Diversified 2		Minor or specialized 3		Specialized no forest 4		non-forest 5	
Age 15+ attending school	8	(9)	8	(9)	8	(9)	8	(8)	8	(8)
Less than grade nine	14	(11)	14	(11)	12	(12)	13	(10)	12	(10)
High school graduation	10	(10)	10	(10)	10	(10)	9	(9)	8	(9)
Trade certificate	3^{5}	(3)	3^{5}	(3)	$3^{4,5}$	(3)	3^{5}	(3)	4	(4)
Non-university post secondary	13	(13)	13	(14)	12^{4}	(12)	14	(13)	13	15
University degree	5	(5)	4	(5)	4	(4)	4	(4)	5	(6)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript

Table 14. Percentage of the 1981 population aged 15 and over in territorial subdivisions who had completed various levels of schooling. Numbers in parentheses are weighted means.

Highest level of schooling	Degree of forest sector dependence: Dual 1		Forest-Diversified 2		Minor or specialized 3		Specialized no forest 4		non-forest 5	
Age 15+ attending school	7	(7)	7	(7)	8	(8)	8	(8)	6	(8)
Less than grade nine	13	(13)	12	(12)	12	(12)	12	(12)	10	(11)
High school graduation	10	(9)	10	(9)	10	(9)	9^{5}	(9)	11	(11)
Trade certificate	2^{5}	(3)	3^{5}	(3)	3^{5}	(3)	3^{5}	(3)	4	(4)
Non-university post secondary	12	(12)	13	(13)	12	(12)	14	(13)	14	(15)
University degree	5	(4)	4	(5)	5	(4)	5	(4)	5	(3)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript

Table 15. Percentage of the 1986 population aged 15 and over in incorporated communities who had completed various levels of schooling. Numbers in parentheses are weighted means.

Highest level of schooling	Degree of forest sector dependence: Dual 1		Forest-Diversified 2		Minor or specialized 3		Specialized no forest 4		non-forest 5	
Less than grade nine	14	(12)	15	(12)	14	(13)	13	(15)	13	(10)
High school graduation	12^{2}	(12)	10^{3}	(11)	12^{4}	(13)	11	(11)	11	(11)
Trade certificate	3	(3)	3^{4}	(3)	3	(3)	3^{5}	(3)	2	(2)
Non-university post secondary	16^{4}	(17)	$15^{4,5}$	(17)	$15^{4,5}$	(15)	18	(17)	18	(18)
University degree	7	(6)	6	(6)	6	(6)	6	(6)	6	(7)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript

Table 16. Percentage of the 1986 population aged 15 and over in territorial subdivisions who had completed various levels of schooling. Numbers in parentheses are weighted means.

Highest level of schooling	Degree of forest sector dependence									
	Dual 1		Forest-Diversified 2		Minor or specialized 3		Specialized no forest 4		non-forest 5	
Less than grade nine	15 [2]	(15)	12	(11)	14	(13)	13	(13)	13	(12)
High school graduation	12	(11)	11	(11)	12	(11)	12	(12)	13	(11)
Trade certificate	3 [4,5]	(4)	3 [4,5]	(3)	3 [5]	(3)	3 [5]	(3)	6	(5)
Non-university post secondary	16 [4]	(17)	17 [3]	(18)	15 [4]	(15)	18	(17)	19	(21)
University degree	5	(5)	6	(6)	6	(5)	7	(6)	5	(3)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript

Table 17. 1981 population mobility in the incorporated communities. Numbers in parentheses are weighted means.

	Degree of forest sector dependence									
	Dual 1		Diversified 2		Forest-specialized 3		Minor or no forest 4		Specialized non-forest 5	
Movers to 1981 population (%)	59	(59)	60	(61)	62	(61)	62	(60)	65	(69)
Inmigrants to 1981 population (%)	34 [4,5]	(34)	38	(34)	38	(34)	42	(37)	4	(48)
Inmigrants from same census division to total inmigrants (%)	11 [5]	(9)	14	(11)	16	(8)	16	(9)	21	(12)
Inmigrants from same province to total inmigrants (%)	54	(57)	54 [4]	(57)	55	(61)	43	(47)	50	(59)
Inmigrants from outside province to total inmigrants (%)	30 [3]	(33)	28 [4]	(31)	24 [4]	(29)	35	(42)	26	(28)
Inmigrants from outside Canada to total inmigrants (%)	7	(9)	6	(6)	8	(9)	7	(7)	5	(7)
Outmigrants to 1976 population (%)	48	(33)	46	(35)	53 [4]	(34)	41	(32)	45	(44)
Inmigrants to outmigrant ratio	0.91	(1.08)	1.48	(1.01)	0.96	(1.01)	2.90	(1.18)	1.18	(1.30)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 18. 1981 population mobility in the territorial subdivisions. Numbers in parentheses are weighted means.

	Degree of forest sector dependence									
	Dual 1		Diversified 2		Forest-specialized 3		Minor or no forest 4		Specialized non-forest 5	
Movers to 1981 population (%)	58	(57)	58	(57)	57	(57)	61	(59)	69	(54)
Inmigrants to 1981 population (%)	37 [3,5]	(35)	36 [5]	(37)	31 [4,5]	(31)	41	(38)	55	(37)
Inmigrants from same census division to total inmigrants (%)	15 [5]	(14)	16 [3]	(17)	11 [5]	(12)	15	(16)	25	(27)
Inmigrants from same province to total inmigrants (%)	53 [4]	(57)	54	(52)	60	(65)	43	(44)	50	(52)
Inmigrants from outside province to total inmigrants (%)	27 [4]	(29)	27 [4]	(29)	24	(22)	38	(39)	22	(20)
Inmigrants from outside Canada to total inmigrants (%)	7 [2]	(6)	5	(5)	6	(6)	7	(7)	4	(4)
Outmigrants to 1976 population (%)	26	(15)	14	(13)	20	(13)	18	(12)	27	(14)
Inmigrants to outmigrant ratio	3.43	(2.46)	3.54	(3.22)	2.60	(2.33)	4.52	(3.74)	3.04	(3.03)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 19. 1986 population mobility in the incorporated communities. Numbers in parentheses are weighted means.

	Degree of forest sector dependence									
	Dual 1		Diversified 2		Forest-specialized 3		Minor or no forest 4		Specialized non-forest 5	
Movers to 1986 population (%)	48	(45)	46	(43)	49	(43)	48	(45)	50	(48)
Inmigrants to 1986 population (%)	23	(20)	25	(20)	26	(18)	27	(23)	29	(28)
Inmigrants from same census division to total inmigrants (%)	17 [2]	(12)	25 [3,4]	(18)	18 [4]	(14)	19	(13)	27	(17)
Inmigrants from same province to total inmigrants (%)	58 [2,4]	(61)	513	(55)	63 [4]	(63)	51	(49)	56	(59)
Inmigrants from outside province to total inmigrants (%)	19 [4]	(21)	20 [3,4]	(22)	14 [4]	(18)	26 [5]	(32)	16	(20)
Inmigrants from outside Canada to total inmigrants (%)	5	(5)	5	(5)	5	(5)	5	(6)	2	(4)
Outmigrants to 1981 population (%)	30 [4]	(27)	31	(29)	33	(26)	35	(29)	33	(32)
Inmigrants to outmigrant ratio	0.71	(0.73)	0.74	(0.69)	0.82	(0.68)	0.72	(0.78)	0.95	(0.91)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Table 20. 1986 population mobility in the territorial subdivisions. Numbers in parentheses are weighted means.

	Degree of forest sector dependence									
	Dual 1		Diversified 2		Forest-specialized 3		Minor or no forest 4		Specialized non-forest 5	
Movers to 1986 population (%)	44	(38)	45	(42)	42	(38)	46	(40)	40	(27)
Inmigrants to 1986 population (%)	24 [3]	(21)	27 [3]	(26)	20 [4]	(18)	26	(23)	22	(11)
Inmigrants from same census division to total inmigrants (%)	21	(18)	16 [5]	(18)	16 [5]	(16)	20	(19)	31	(36)
Inmigrants from same province to total inmigrants (%)	54 [4]	(54)	54 [4]	(49)	59 [4]	(61)	43	(41)	45	(39)
Inmigrants from outside province to total inmigrants (%)	22 [4]	(24)	25	(28)	21 [4]	(18)	32 [5]	(34)	14	(13)
Inmigrants from outside Canada to total inmigrants (%)	3 [4]	(4)	5 [5]	(5)	5 [5]	(5)	6 [5]	(6)	11	(14)
Outmigrants to 1981 population (%)	33 [2,3,5]	(30)	26 [5]	(25)	25 [5]	(22)	30 [5]	(29)	49	(33)
Inmigrants to outmigrant ratio	0.67 [2,5]	(0.66)	1.05 [3,5]	(1.11)	0.77 [5]	(0.83)	0.81 [5]	(0.74)	0.26	(0.28)

Note: Superscripts indicate statistically significant differences between the simple mean of the category containing the superscript and the simple mean of the category number of the superscript.

Appendix 1

Census Definitions and Notes

Our procedures were to some extent determined by the characteristics of the censuses which took place in 1981 and 1986 (Statistics Canada 1983, 1988). Some of the characteristics of these censuses are discussed in the following definitions and notes.

Definitions

1. Census data is divided according to the standard geographic census code system of Statistics Canada into census subdivisions which consist of incorporated communities, census agglomerations and territorial subdivisions. Incorporated communities are communities that have been granted power by the Province in the form of a charter. They have a local governing body under the jurisdiction of the Municipality Act. The territorial subdivisions cover geographic areas which contain a number of unincorporated settlements. Three categories of census subdivision were excluded:

Census metropolitan areas (CMA) (Greater Vancouver Regional District and Capital Regional District and Capital Regional District except for Subdivision C) due to the diverse nature of their economic base.

Communities within commuting distance of a CMA as work and services are readily accessible outside the confines of the community's boundaries. This eliminated areas surrounding Greater Vancouver including the Central Valley Regional District and the Dewdney-Alouette Regional District.

Indian reserves.

Throughout the analysis, communities with a population of less than 50 were excluded, as it is assumed that they are incapable of being self-sufficient and therefore must be dependent on another community. The forest sector labor force resident in these towns and villages is captured in the territorial subdivision data.

2. When interpreting total outmigrants for 1981 (1986), consider the geography as the 1976 (1981) place of residence. In all other cases, the geography refers to the 1981 place of residence.

3. Inmigration is defined as movement into a territorial subdivision or incorporated community from elsewhere in Canada, relative to the 5-year interval.

4. Outmigration is defined as movement out of an incorporated community or territorial subdivision to elsewhere in Canada relative to the 5-year interval.

5. Participation rate refers to the percentage of persons who worked, had a job, looked for work, and were available to start work during the week prior to census day.

6. Income is based on total income as opposed to employment income.

7. Incidence of low income is based on total income of a family unit adjusted for the federal Child Tax Credit, size of the family unit, and size of the area of residence. The position of each unattached and economic family is determined in relation to low-income cutoffs based on the 1978 Family Expenditure Survey and updated by changes in the consumer price index

Notes

1. New census divisions were created between 1981 and 1986. In a majority of instances the 1981 census division was simply partitioned into two separate divisions. To ensure comparability between the census years the statistics for these census areas were aggregated to conform with the 1981 census. The following is a list of the affected census divisions:

Alberni-Clayoquot subdivisions A and B
Cowichan Valley subdivisions A, B and C
Fraser-Cheam subdivisions B and C
Kitimat-Stikine subdivisions C and D
Peace River-Liard subdivisions A, B, C and D
Comox-Strathcona subdivisions B and D

The 1981 Cariboo subdivisions A and B were partitioned into three subdivisions in 1986. The new division included portions of both the old subdivisions A and B, which made simple aggregation of the statistics impossible. Therefore, we assumed the same population distribution in Cariboo A and B in 1986 as in 1981 (approximately 85%-15%) and recalculated the statistics appropriately. All ratios, such as

unemployment rates and participation rates were assumed to be the same.

2. Some incorporated communities experienced boundary changes between 1981 and 1986. These changes also affected the territorial subdivisions surrounding the communities. Statistics Canada reported the 1981 population figures in original and adjusted form. To make the two census years comparable the 1986 socioeconomic statistics were re-estimated, assuming the 1981 boundary. Figures were adjusted such that their absolute value changed but their ratios did not. The following is a list of adjusted areas:

Alberni-Clayoquot subdivisions A and B
Tofino
Bulkley-Nechako subdivisions A and B
Vanderhoof
Cariboo B
Williams Lake
Columbia-Shuswap subdivision B
Revelstoke

Other census divisions were adjusted, however, these adjustments were relatively minor. Therefore, they were not considered significant enough to warrant re-adjustment.

3. Statistics Canada reported a geographical boundary error in Skeena-Queen Charlotte, subdivision A. The population was overstated in 1986. To correct for this error, all statistics for the region were decreased proportional to the population error.

4. Statistics Canada did not report outmigration numbers in the publication from which the 1986 census data was drawn. Therefore, estimates of the total outmigrants between 1981 and 1986 had to be made using the following formula:

Outmigrants = (Pop81) + (In86) - (Pop586) - (Deaths)

where:

Outmigrants	=	total number of outmigrants between 1981 and 1986
Pop81	=	total population in 1981
In86	=	number of inmigrants between 1981 and 1986
Pop586	=	population 5 years of age and older in 1986
Deaths	=	number of deaths between 1981 and 1986.

Migration ratios are based on the population 5 years of age and older at the time of the census so as to exclude any births since the last census date. When calculating outmigration the 1981 total population must be used because those who were under 5 years of age in 1981 would be 5 years and over in 1986.

The number of deaths is not reported in the census data and therefore had to be estimated. A rural death rate for British Columbia was obtained from British Columbia Vital Statistics and used to estimate the number of deaths for each community and territorial subdivision. Although only approximations, the number of deaths in rural British Columbia between 1981 and 1986 was low relative to the total population. Even with a large margin of error there would only be a small overestimation or underestimation of outmigration numbers.

Appendix 2

Methodology

The test to determine if the means of various social and economic characteristics were significantly different from each other, depending on the degree of forest sector dependence in the community or area, was calculated using the general linear model in the statistical computer package SAS (SAS Institute, 1985). The general linear model is part of the Analysis of Variance Method (ANOVA) for unequal sizes. The ANOVA table and formulas are shown in Table A1 (Huntsberger and Billingsley 1973).

Table A1. Analysis of variance table for unequal size groups

Source	DF	SS	MS	F
among groups	k-1	$\sum_i n_i(\bar{X}_{i\cdot} - \bar{X}_{\cdot\cdot})^2$	G	G/W
within groups	N-k	$\sum_i \sum_j (X_{ij} - \bar{X}_{i\cdot})^2$	W	
Totals	N-1	$\sum_i \sum_j (X_{ij} - \bar{X}_{\cdot\cdot})^2$		

where

DF - degree of freedom
SS - sum of squares
MS - mean of squares
F - F distribution value
k - number of groups
N - total of observed values
n_i - size of each group
G - mean square among groups $[(\sum_i n_i(\bar{X}_{i\cdot} - \bar{X}_{\cdot\cdot})^2)/(k-1)]$

W - mean square within groups $[(\sum_i \sum_j (X_{ij} - \bar{X}_{i\cdot})^2)/(N-k)]$

The G/W ratio has a F-distribution with k-1 and N-k degrees of freedom. The F-distribution belongs to a two-parameter family of distributions whose parameters are degrees of freedom, γ_1, for the numerator mean square, and, γ_2, for the denominator mean square. The G/W ratio is compared with F-tables to determine if there are significant differences between the means of areas with differing degrees of forest sector dependence. This ANOVA is done for both communities and subdivisions.

Using the F-tables, the level, or probability value (p-value), the ratio G/W would fall into can be determined[1]. Using the p-value a conclusion may be made for evidence or no evidence against H_0. The null hypothesis for this study is that there is no difference between the five degrees of forest sector dependence in the incorporated communities and territorial subdivisions. A widely accepted procedure for using the p-value is shown in Table A2. The smaller the p-value the stronger the evidence against the null hypothesis. This method does not express the results as being significant at a certain percentage level or as rejecting or accepting an hypothesis but rather gives a weight of evidence for or against the hypothesis.

Table A2. P-value test for evidence against or for the null hypothesis

P-value = p	Weight of evidence against the null hypothesis in favor of the alternative hypothesis
$p \leq 0.01$	very strong
$0.01 \leq p \leq 0.05$	strong
$0.05 \leq p \leq 0.10$	moderate
$0.10 \leq p$	none

The next procedure is the Multiple Comparison Method (Larson and Marx 1981; Montgomery 1976) which tests one mean, or a group of means, against another mean or group of means. The comparison of group means of implies a linear combination among group totals such as:

$$P(F\gamma_1, \gamma_2 \geq Fa, \gamma_1, \gamma_2) = \alpha$$

The first F value is equal to G/W. The α is the percentage point of the F Distribution Table. The second F value is from the F Distribution Table to determine the level the ratio G/W would fall into with the same parameters as the first F value.

[1] Under the assumption that the null hypothesis is true, computing the probability that a rerun of the same experiment would produce evidence against the null hypothesis in favor of the alternative hypothesis at least as strong as the observed evidence; and this probability is the p-value.

where

$$C = \sum_{i=1}^{a} c_i x_i$$

a is the total number of division levels
c_i is the contrast coefficient
x_i is the mean of the division level
C is the linear combination

with the restriction that

$$\sum_{i=1}^{a} c_i = 0$$

This restriction is added so that the comparison is done equally. That is so the test is not biased in favor of one division or group. These linear combinations (C) are the coefficients used to compare the mean or means with one another. The different combinations (the columns of Table A3) are called contrast coefficients.

The sum of square for any unbalanced contrast is:

$$SSc = \frac{\sum_{i=1}^{a} (c_i x_i)^2}{\sum_{i=1}^{a} (n_i c_i)^2}$$

where n_i is the number in the unbalanced blocks and has one degree of freedom.

Since the study has unequal group sizes, the calculation for the sum of squares for the contrast was calculated as shown in the formula above. For the F-test on the contrast, SSc is divided by the within group mean square (the mean square error or W). The procedure is the same as for the ANOVA test to determine the p-value and draw a conclusion, but the degree of freedom for the numerator is 1. Since the contrast is a comparison of two means, one degree of freedom is used. One degree of freedom is left when we subtract one degree of freedom from the numerator from the ANOVA table.

The contrast coefficients are chosen prior to examining the data. If coefficients are selected after examining the data, there may be a tendency to construct tests that would correspond to large observed differences in means. The large differences could be the result of the presence of real effects or be the result of random error. If the largest differences are consistently compared, type I error of the test would inflate, and the selected observed differences will be the result of error[2]. The contrasts used in this study are presented in Table A3. The columns in Table A3 all sum to zero to show which division means are being compared and show that the restriction that the sum of the $c_i = 0$ has been met.

[2] a = P(type I error) = P(reject H0 | H0 true).
This the probability of rejecting the null hypothesis (no difference between means) given that the null hypothesis is true.

Table A3. The contrast coefficients used

Degree of forest sector dependence	Coefficients of Contrasts			
	Dual vs other	Diversified vs other	Forest-specialized vs other	Minor or no forest vs other
Dual	1 1 1 1	0 0 0	0 0	0
Diversified	-1 0 0 0	1 1 1	0 0	0
Forest-specialized	0-1 0 0	-1 0 0	1 1	0
Minor or no forest	0 0-1 0	0-1 0	-1 0	1
Specialized non-forest	0 0 0-1	0 0-1	0-1	-1